



# Terra C7 RSB calibration impact on Atmosphere tests

MCST

September 11, 2023



## ➤ Cloud Product (Slides 4-16):

- Aqua PC bands: the difference in Cloud\_Top\_Height (CTT) are higher than expected. Checked bands 33, 34, and 36 for MYD06\_L2 product (Slides 4-10).
- **Terra: the cloud group found significant positive trends in Terra C7 Cloud Effective Radius (CER) in SWIR bands**, look to be related to negative trends in the 1.6 and 2.1  $\mu\text{m}$  bands (Slides 11-15).
- Cloud Team found a slight dip in CER starting  $\sim$ 2016, which may be caused by the rapid degradation in mirror side polarization for Terra after the safe-mode event for Terra in 2016.

## ➤ Dark Target Aerosol Product (Slides 19-25):

- **Terra: DT group expects C7 Terra will reduce the Terra-Aqua offset for DT aerosol optical depth (AOD at 550nm). In fact, over land, Terra has positive offset.**
- Large change in “Ångström exponent” are also observed over ocean.
- Some masks are used to select the pixels for AOD retrieval, which may be affected by the L1B reflectance changes. (B26 = 1.38  $\mu\text{m}$ , B31 = 11  $\mu\text{m}$ , etc.)

## ➤ Deep Blue Aerosol Product (Slides 26-28):

- Terra: Large difference in Band 8 (412 nm) for Terra is mainly coming from the rapid degradation in mirror side polarization for Terra, starting after the safe-mode event for Terra in 2016.
- Some change in the 470nm (Band 3) and 650nm (Band 1) are relevant to change in C7 L1B.

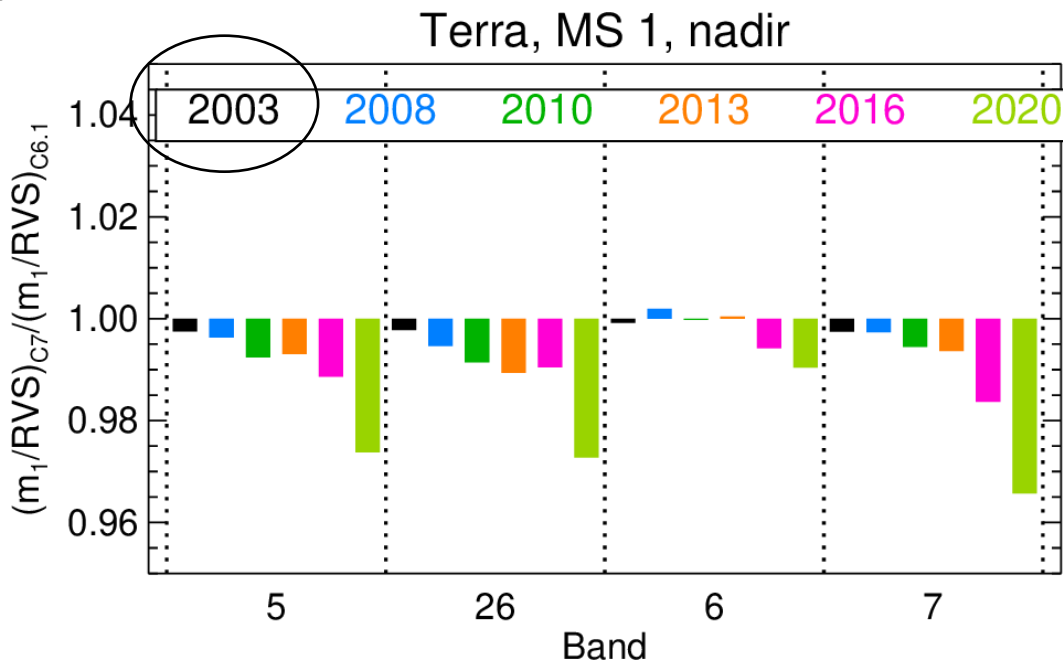


# Overview of Terra RSB changes from C6.1 to C7 L1B



## SWIR bands (5, 26, 6, 7)

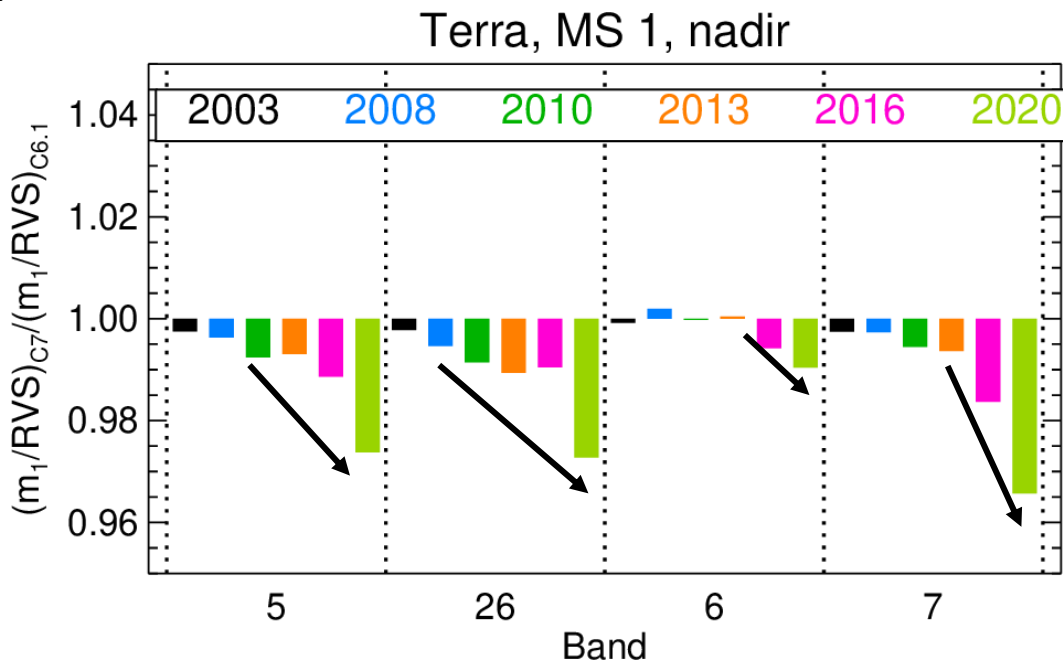
- There are no mission-long **offsets** between two Collections for these bands: so, early in the mission, C6.1 and C7 L1B reflectance should be very close.
- There are **trend differences** between the two Collections: C6.1 L1B showed a reflectance drift in all SWIR bands, especially after 2016 safe mode, which we tried to correct in C7. Change in crosstalk algorithm could possibly lead to some scene-dependent trends.



Gain ratio at mission beginning is 1.0.

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C7 reflectance trends lower than C6.1, especially from 2016 to 2020.



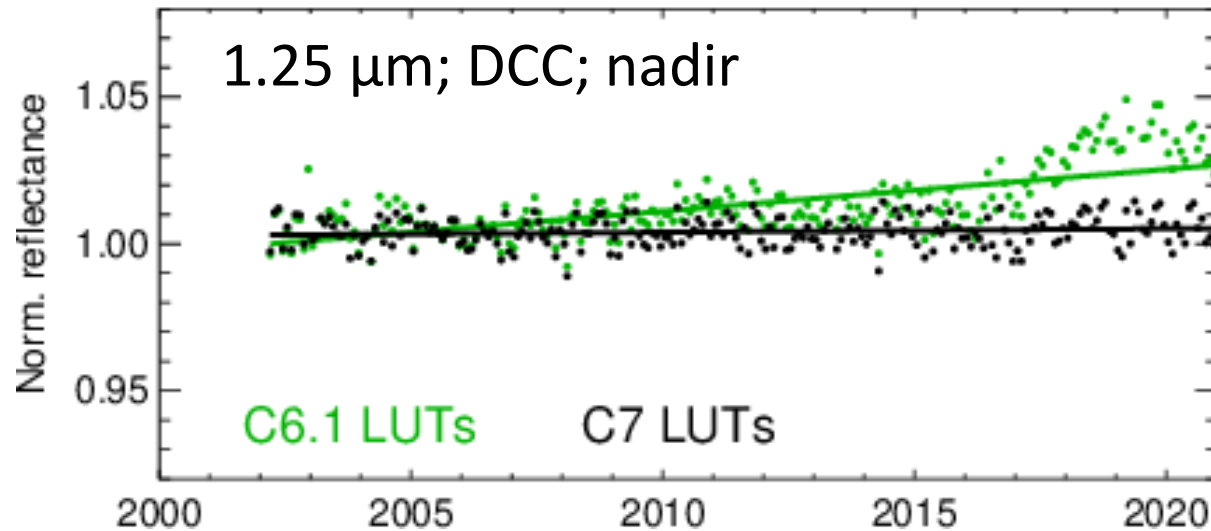
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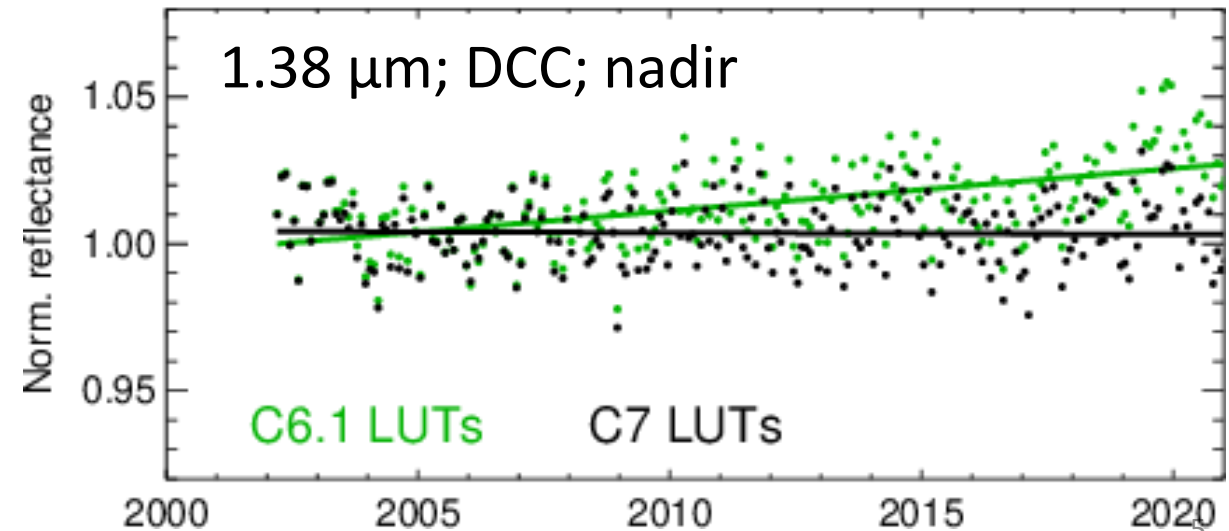
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Terra band 5, MS 1, Frame 650



Terra band 26, MS 1, Frame 650





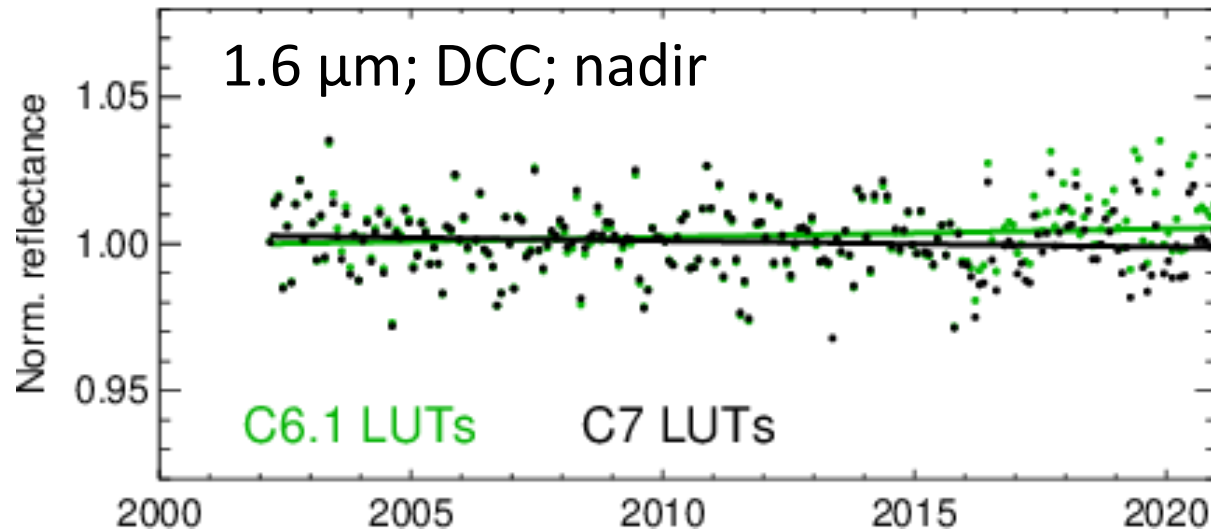
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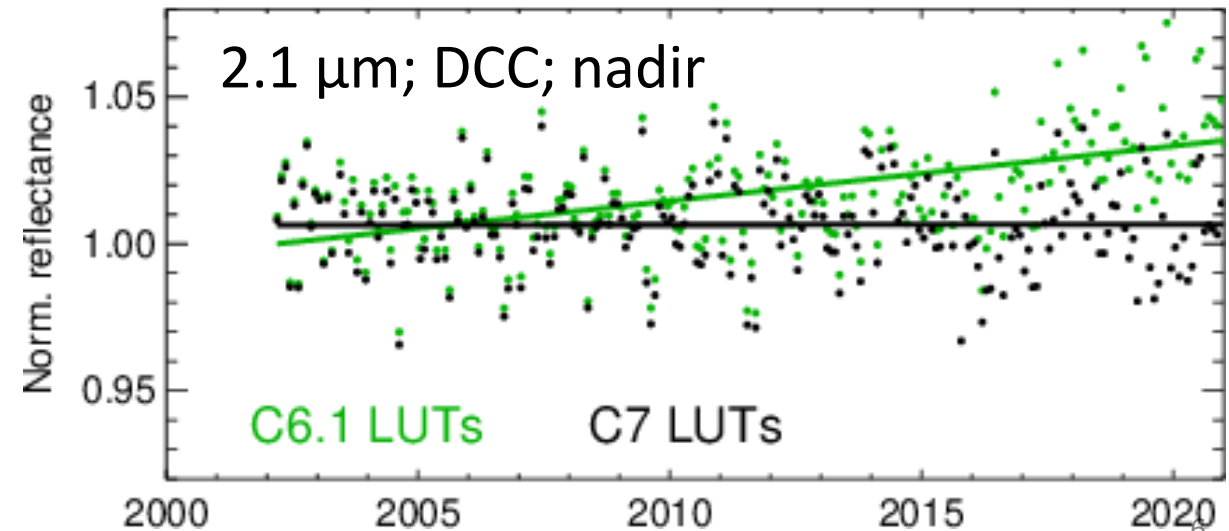
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Terra band 6, MS 1, Frame 650



Terra band 7, MS 1, Frame 650



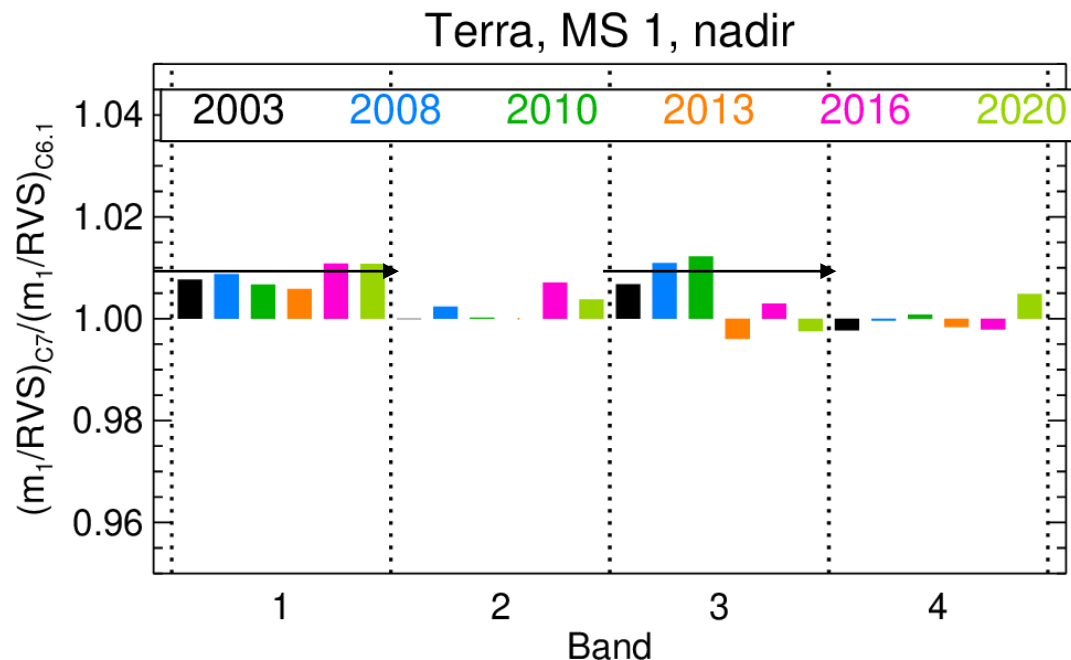


# Overview of Terra RSB changes from C6.1 to C7 L1B



## Land bands (1, 2, 3, 4)

- Bands 1 and 3 have some mission-long **offsets** between two Collections: C7 is 0.5%-1.0% higher reflectance than C6.1 on average. Bands 2 and 4 have minimal change.
- There are no **trend differences** between the two Collections for any of these bands.
  - Only exception is band 3 (470 nm), which is impacted by polarization for part of the swath width.
  - Polarization correction at L2 for band 3 (and blue ocean bands) must be done differently in C7 than it was in C6.1.





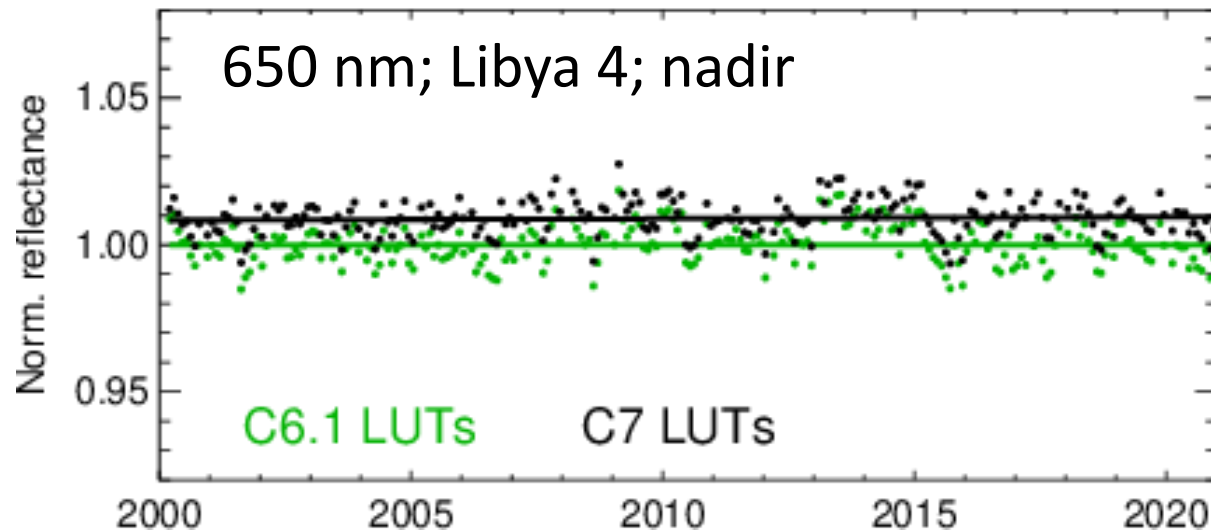
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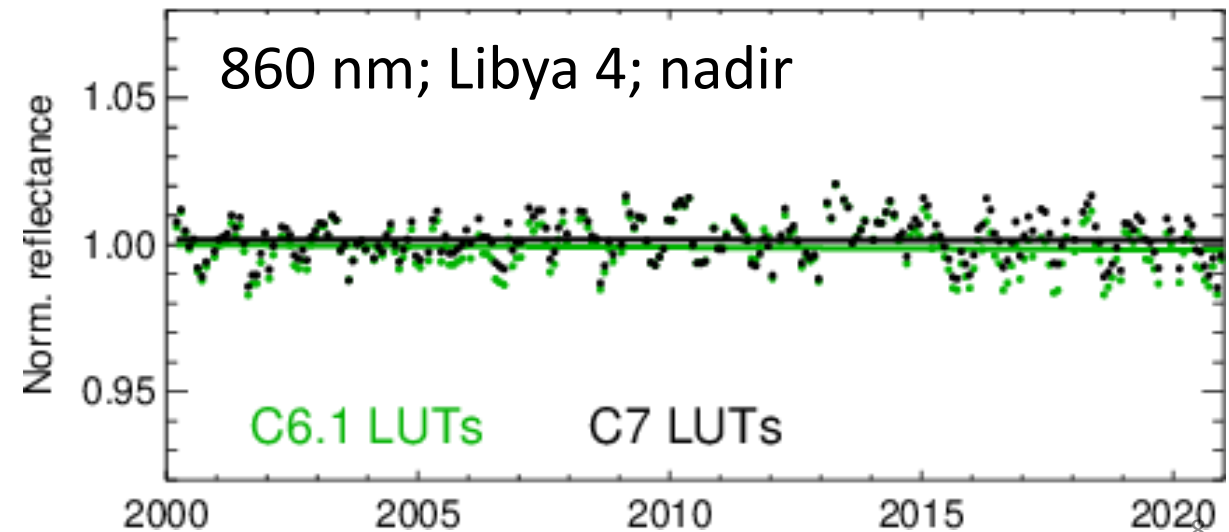
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Terra band 1, MS 1, Frame 622



Terra band 2, MS 1, Frame 622







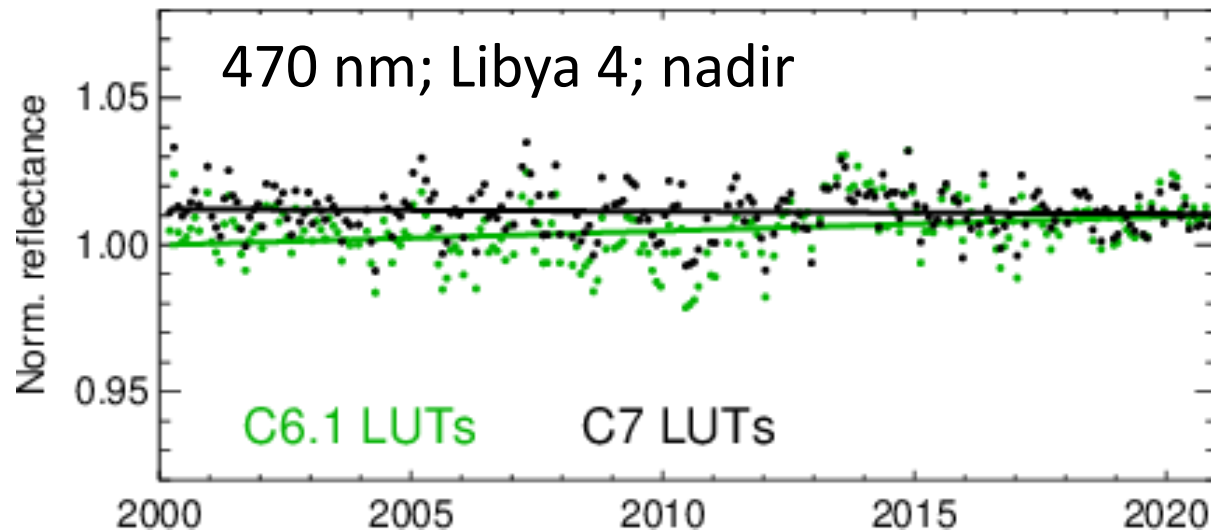
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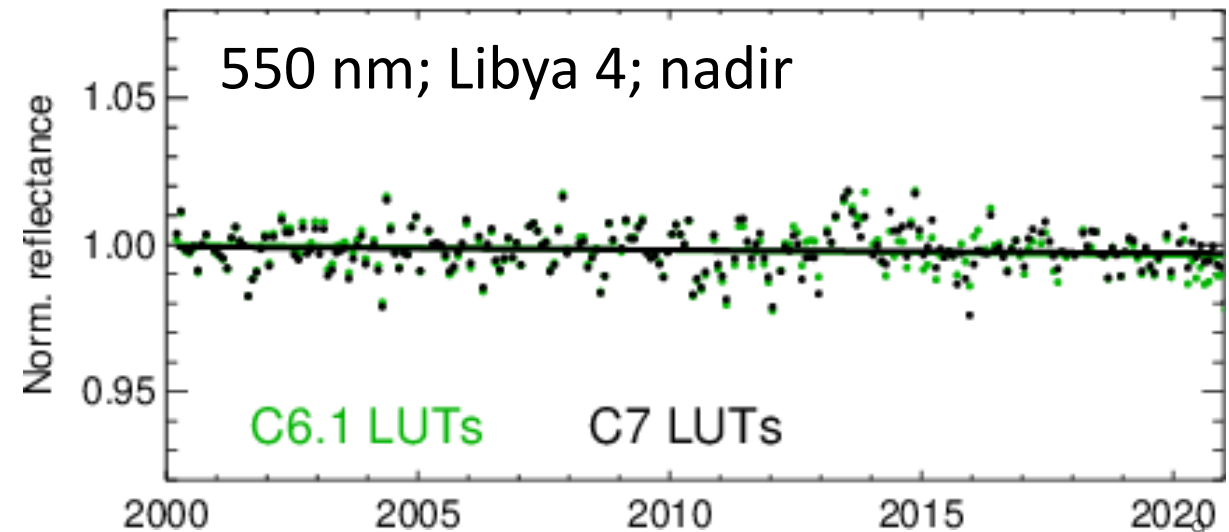
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Terra band 3, MS 1, Frame 622



Terra band 4, MS 1, Frame 622





# Summary



## **“Terra: the cloud group found significant positive trends in Terra C7 Cloud Effective Radius (CER) in SWIR bands”**

- A change in trend from C6.1 is expected, due to errors in C6.1 trends.
- Reason for possible overcorrection?
  - Change in crosstalk correction algorithm for C7 could possibly lead to scene-dependent differences in trends.
  - For band 26 ( $1.38 \mu\text{m}$ ), there is a known non-linear gain problem that could also lead to scene-dependent differences in trends. C7 L1B algorithm uses DCC (high radiance) to stabilize calibration, which may not be best for low radiance scenes.

## **Terra: DT group expects C7 Terra will reduce the Terra-Aqua offset for DT aerosol optical depth (AOD at 550nm). In fact, over land, Terra has positive offset.**

- Not clear to us why this happened.
- Would reflectance offsets at 650 nm and 470 nm bands impact this?